1 Introduction

Malcolm Brynin, Ben Anderson and Yoel Raban

Who can doubt that new technologies, especially information and communication technologies (ICTs), are now an integral part of a society profoundly different from that which has gone before? Computers are a universal tool in all leading economic nations and increasingly so in the poorer countries. The Internet is a tool of daily life for hundreds of millions, while third-generation mobile phones will soon be the norm. New, less hierarchical networks of communication are being developed and new goods and services are proliferating. Services and information can be acquired virtually instantly. For some time it has been asserted that we are, or soon will be, in a period of revolutionary social and economic change as fundamental as the Industrial Revolution (Drucker, 1969; Bell, 1973; Dutton *et al.*, 1999; Castells, 2000).

Much analysis of the social importance of new technology examines the effects of technological innovation in people's everyday lives. Does the new technology lead to a qualitative shift in the way we run our lives – making it more efficient, more fulfilling, richer or, of course, possibly the reverse of all of these? But the findings of some research hints at a more fundamental social change, of the emergence of a new form of society where the new technologies are held to variously erode, create, rework, but alternatively simply *transform*, for good or ill (and sometimes simultaneously), the way people perform many important aspects of their lives (Kraut *et al.*, 1998, 2002; Franzen, 2000, 2003; Nie, 2001; Wellman *et al.*, 2001; Gershuny, 2003). Each finding is implicitly treated as the tip of a hidden iceberg. What is hidden is the future.

However, radical change is unlikely, and not only because of the deflation of the dot-com bubble. The parallel with the Industrial Revolution (and indeed the label 'revolution') is unconvincing on numerous counts – as, indeed, we were forewarned (Trabner, 1986; Schnaars, 1989). In a particularly well-argued critique, Christopher May (2001) suggests that there are four linked tenets of the 'revolution':

- social revolution,
- transformation of economic relations,
- changes in political practices and the communities involved,
- terminal decline of the state and its authority.

May finds little evidence to support any of these general tenets. We need to distinguish between form and substance. This argument resonates with Gershuny's assertion that, as technology changes, our lives carry on in familiar ways; what changes is the means through which this happens (Gershuny, 1978, 1983).

In addition to conceptual or meta-analyses such as May's, a growing body of empirically based journal articles and books have sought to provide a measured response to the rise of the new ICTs. These include Wellman and Haythornthwaite's collection (2002) and also that of Kraut *et al.* (forthcoming). In the main, these collections have sounded a note of evidence-based caution. As with May, they conclude from the data to hand that it is clear enough that changes are happening, but it is not at all clear what the threads of causality are and what their future significance might be.

So why do we care about change and effects?

There are perhaps three major reasons to be interested in the social side of ICT-related change, which continues to engage the minds and resources of a wide range of researchers. One, which is also the most direct, is the continuing need to test the possibility that we are on the cusp of, or perhaps embedded within, a major social and economic transition. We have cast doubt upon this idea above, but the possibility is both fascinating and important, and cannot be lightly dismissed. Even where fundamental change is unlikely, we can help to map and test the significance of the myriad of small ICT-related changes. Part of the rationale for this book is to help address this issue both substantively, through a range of research results, and methodologically, through the demonstration of the kinds of data and analysis required.

Academic work does not operate in a social vacuum. Many researchers act as independent advisors to, and auditors of, policy-makers and NGOs. Some of the chapters in this book are written by authors who have these twin aims in mind. A second rationale for research in this area, and in particular for this book, is therefore that policy-makers and non-governmental organisations throughout the world need to understand the sorts of changes that are occurring in society, but which are not necessarily visible in or through official statistics. Readers will be familiar with policy initiatives from Chile to the USA or South Korea, or with the United Nations/International Telecommunications Union sponsored World Summit on the Information Society.[1] Also at the supranational level the European Commission has initiated the e-Europe and i2010 initiatives, which are explicitly about harnessing the potential of ICTs to help achieve policy objectives of social cohesion, inclusion and economic growth (CEC, 2005). Clearly, in order to proceed in an evidence-based manner, such policy initiatives need to be based on analyses of what social benefits ensue for whom and from what kinds of ICTs.

Commercial actors also have a need to understand the same processes, for instance to see how their markets and their supply chains are changing as

ICTs become embedded, but more especially where their business is selling ICT products and services. While academics do not often ally themselves to such goals, it seems obvious to us that there are overlaps between them. Even if social scientists are rarely privy to the vast amount of commercial data that exist on the social demand for new technologies, services or brands, and despite the gulf in analytical goals between academic and commercial researchers, both are inevitably interested in the impact of social divisions on ICT take-up and usage. The typology in the literature on diffusion between innovators and laggards, for instance, directly reflects this joint interest. Commercial interests wish to locate those who will both buy a new idea and stick with it (and tell others about it), putting into their assessments of how to find such people whatever information they might have on income, preferences and prices. The social scientist has the same underlying interest, but will use this or related information to say something about more social processes. Thus, for instance, research on social exclusion from the benefits of ICTs is simply the obverse of the commercial interest in social inclusion.

Malleable technologies

The introduction of any new good or service is often carried out with considerable uncertainty over the target group and the match between its needs and the affordances of the product. It is not surprising, therefore, that early commercial and policy expectations are often misplaced (Anderson *et al.*, 2003). Unforeseen outcomes are a part of the process of technological change. The increase in firepower in seventeenth-century armies led to 'limited' warfare where attempts were made to reduce casualties. Thus, while new technology may drive much industrial change, it often does so in unplanned and unpredictable ways (Form *et al.*, 1988; McLoughlin and Clark, 1994: 22–33; Kling, 1996). McLoughlin and Clark (1994) stress the adaptive, and even accidental, side of technological development. No technologists, policy-makers or investors can wave a magic wand to make people do things suddenly very differently. People have needs, constraints and preferences that determine which innovations succeed or fail. Technology cannot have effect unless there is social room for it to do so. People accept the technologies they want at the same time as they experiment with and adapt them to their needs. The meaning of the technology itself may change through use, whether at work (Robinson, 1993) or in the domestic setting – creating what Bakardjieva calls 'use genres' (Bakardjieva, 2005). This also makes prediction especially complex.

In the case of the new ICTs, the problem is even greater as many new technologies are malleable and multi-functional. In contrast to older technologies such as the television or the telephone, new ICTs are often platforms for many different types of service. Thus the mobile phone was a simple instrument built on the familiar functions of the fixed-line telephone, but is now more complex. The home computer is a platform

providing quite disparate functions, which therefore attracts a range of often distinct interests and could have a range of individual level social benefits that cannot be meaningfully aggregated. The Internet is a delivery mechanism for a complex bundling of services and functions. Thus, while it might be possible to analyse and predict the demand for social benefits of specific services, it is extremely hard to predict the take-up of new technologies of the sort that form the subject of this book. There is simply unlikely ever to be a single 'killer technology' at this level.

We can demonstrate this, if in rather simple form, through analysis of the 1998–2001 *Home-OnLine* dataset of British households (Anderson and Tracey, 2001). We do this by summarising the results of a large number of logistic regressions where usage of a technology or service, or willingness to innovate, is the dependent variable, and a range of variables such as age, family, education, work, preferences (e.g. to the telephone – labelled 'telephonic' in the table), division of household labour and time-use as measured by a time-use diary) form the explanatory variables. The results indicate a general tendency (which has, in turn, been assessed subjectively rather than through some computational method). The end result is therefore similar to the kinds of profiles and segmentation models generated by commercial or market research using cluster analyses. However, what we present below are not profiles but bundles of profiles. The characteristics associated with usage of a technology need not occur in one person, and are often extremely unlikely to, whilst some characteristics are of households rather than of individuals.

Table 1.1a shows the results for three forms of ICT usage. The first, the number of purchases made in a period of time over the Internet, shows access to a fledgling technology. The second, the size of phone bills, demonstrates consumption of a mature technology. Computer usage, in the middle

Table 1.1a Factors predicting usage and uptake of goods and services

	Internet purchases	*Computer usage*	*Phone bills*
Demographics	Young male	Young	Young male
Education	High/medium	High	High or low
Family	Couples/kids	Children	Children
Chores	No	–	Housework
Family beliefs	–	Illiberal	Liberal
Shopping	Equal/shared	Equal/unshared	Unequal
Telephonic	–	–	High
Newspaper	Quality	Quality	Quality
Leisure activity	Indoor	Cinema etc.	Outdoor/social
Income	Own pay	Both	Household
Work time	–	–	–
Leisure time	N/A	–	Cinema etc.
Social time	N/A	No	No
ICT time	N/A	Little TV	Telework

column, is somewhere in between. These 'profiles' are in some respects quite different. Although users or high users of all three are likely to be young and male, and also in some sort of family relationship, education is not always a consistent predictor. The distribution of household tasks varies across the profiles, as do beliefs relating to the family and work (for instance, whether women should work). Attitudes to phone usage are only notably high where phone bills are high. Leisure activities vary considerably, and while income is related to usage, in one case only own pay from work counts, in another total household income, and in the third, both of them. Perhaps the most powerful relationship is between phone usage and the use of a computer for work at home (telework) – a clear case of a functional relationship.

Table 1.1b looks at a specific example of computer usage in the third column – of games (measured through the diary). It can be seen that the profile is quite different from that of general computer usage since it describes young men with low incomes and few interests, still living with their parents. When we move to questions which specifically ask about the willingness to try new products (see also Diduca *et al.*, this volume, Chapter 7) there is no real gender difference and education is not high, which makes these people stand out: in particular, they are quite different from those who are willing to try new technologies – who are young, male and have few apparent other interests.

Do these differences represent different points on the diffusion curve or, rather, a different bundle of preferences and constraints in each case? Both

Table 1.1b Pactors predicting usage and update of goods and services (cont.)

	Tries new technology	*Tries new products*	*PC games*
Demographics	Young male	Young	Young male
Education	High	Medium	Medium
Family	Single	–	Children
Chores	–	Housework	–
Family beliefs	–	–	–
Shopping	–	Unequal	Self
Telephonic	–	No	–
Newspaper	None	Midbrow	None
Leisure activity	–	Social	–
Income	–	Own pay	Negative
Work time	Low	High	Low
Leisure time	–	No hobbies	No hobbies
Social time	No	Yes	No
ICT time	PC	PC	Internet

Source: Home-OnLine Survey, UK Data Archive.

Note
For cells marked N/A, requiring time measures, analysis was not possible as a result of the diary sample being significantly smaller than the full sample.

might be a factor. That is, it is possible that when (or if) the Internet is as widespread as the fixed-line telephone, then high usage on one will be similar to high usage on another. However, this is unlikely to be the case. The difference between high users of television and of the telephone already indicates this. The choices people face, dictated by what the technologies can do, are between complex clusters of preferences. This leads to very considerable uncertainty on the part of consumers, investors and social scientists; one of the most significant reasons for this is the increasing malleability of the technologies in which we are interested. How can we either predict the take-up of, say, a future generation of computers or understand what social role they play, when different groups use these for different purposes, and while these purposes simultaneously change? There is no single process of change, but a stream of changes.

This has implications for both the way we conceptualise and analyse change and the applicability of our results. It suggests that we cannot simply analyse the demand for, or social benefits or disbenefits of, the Internet or the mobile telephone. Rather, we need to ask questions about different kinds of uses of different kinds of services. We should not expect to see many 'effects' of Internet adoption because the uses to which the services will be put may vary widely across a population and over time. Instead we should focus at a lower level, on ICT-mediated activities such as online shopping, interpersonal communication (via text, phone calls, voice mail, email, instant messaging, chat, etc.), or job and health information foraging. As editors we have encouraged some contributors to this book to pose their questions and frame their analysis at this level.

How do we know what causes change?

With this as background, we must now consider the extent to which causal explanations of the role of ICTs in social and economic change are possible. After all, if policy-makers or commercial actors want to ground their decisions not only on evidence but on some real sense of underlying social processes, they need some explanatory model that can help them to take decisions and reduce, or at least be forewarned about, otherwise unanticipated effects. In this instance a model based on association (e.g. 'those with Internet access have more social capital') is not sufficient. We need to know if using particular Internet-delivered services makes any real difference. Or is it simply that those with greater social resources are more likely to adopt the Internet simply because they are more wealthy and better educated?

However, causality is not something we can necessarily pick out conceptually, let along empirically. If we view technological change in terms of its social construction rather than in terms of its social effects alone, then we can especially see that the causal flow is often multi-pathed and even multi-directional. Analytically, we have to say it is not clear how far down these paths we should go. They make causal analysis very difficult. In actor

network theory, for instance, technological outcomes are the result of a series of 'translations' of technology design, implementation and use. Technology is 'performative' rather than given (Latour, 1986, 2000). Even more radically, Grint and Woolgar argue that we can interpret all technology in social terms (in much the same way, perhaps, that Marx viewed capital as the final form of all the labour that goes into its construction). Even a bullet already in its trajectory has a social rather than a technological meaning. We have to go ever further back in the causal process to find not a cause, let alone an original cause, but yet more causality to unravel. Grint and Woolgar liken the quest for ultimate causation to stripping away layer after layer of an onion, only to find 'there is nothing at the centre' (1995: 164).

What then is the 'stopping rule'? The relationships at the heart of the discussion of the social significance of technological change are certainly complex. But that does not mean that they should be viewed as endlessly recursive or regressive, so we forever chase our own tails. This problem is certainly acknowledged. Grint and Woolgar, for instance, argue that technical phenomena are 'constituted (rather than . . . shaped, affected etc.) by social processes' (Grint and Woolgar, 1995: 51). Cause and effect here become indistinguishable. Each apparent effect is a cause in some further process. This is analytically neat but empirically insecure. The relationship between the technological and the social becomes opaque, even somewhat mysterious, almost personal to the analyst. It is no wonder that Grint and Woolgar call their own method 'hard work' (1995: 114).

It also makes it very difficult to develop a general theory of social change related to technology. This paradoxically returns us to the quest for effects. At some point technologies or products and service come into the social domain through the market or through policy/NGO interventions. Whilst we always need to consider the social nature of their development and the increasingly tight loop between use (consumption) and design, we need, at specific points in time, to isolate how people are affected by technological change, even if our view of the section of the causal chain we are analysing would differ if we could examine a longer stretch. Ultimately, after all, the chain is infinite. Probably none of the analysts discussed above, who have helped to unravel the social meaning of technology, would object to the simple idea, for instance, that technology is a mediator and sometimes intensifier of existing social processes. This is a limited aim.

Even here we need to be precise about the level at which we expect change to occur. In the introduction to the volume by Kraut *et al.* (forthcoming), the analytical problem is viewed as one of being sure what level you are dealing with. The most basic is where we analyse technology as a tool and expect only limited behavioural changes, for instance through substituting one tool for another to achieve the same goal. However, new technologies might be associated with new goals, which form a broader level of effects. If we can additionally observe changes in welfare outcomes, we again move to a more extensive level. Finally, if the summation of these changes

induces or interacts with some overall change in society, we are at the broadest of all levels.

The fundamental issue then becomes not, for instance, whether we can genuinely infer from a small qualitative analysis that the Internet or any other technology is making society closer, but whether the micro-level effects we see aggregate into societal-level effects. As we have already suggested, most analysts (including ourselves) like to think that what we find is only the tip of the social iceberg. But in practice the relationship between the micro and the macro, between the small and the large, is often indeterminate. At the very least, the whole is generally less than the sum of its parts. But also, the sum might itself take a long time to work out. In the relatively few years for which we generally have relevant data, the social phenomena of interest are often difficult to observe effectively. In 2030 and with the benefit of hindsight, we may be able to discern a cumulative, aggregate change and thus be able to argue more cogently about revolution or evolution, but in the here and now this is less certain. We need to think very carefully about the methods we use to measure change and to ascribe causality.

How is this to be done?

When we are looking for causal relationships, we can do this in the aggregate (e.g. national level) or through micro-level techniques. The former takes averages and sees how these relate to each other. While comparing national averages obscures the micro-level variation that occurs below that level, research of this sort is at least avoiding possibly unwarranted inferences from micro-level to macro-level change. The chapters in this book by Dutton, Shepherd and di Genarro, by Rothgang and Schmidt, and by Dehio and Graskamp, are examples of the aggregate approach. Most of the rest of the analysis presented in the book is at the micro level, primarily of the individual or household.

This might be qualitative or quantitative, and we have examples of each here. Both have different things to offer, but both also have some overlapping problems. These relate to the above discussion of whether or not we really can separate out cause from effect. There has been a great deal of statistical effort designed to overcome these problems. We take as an example the case of the computer wage premium that has developed within economics, starting with Krueger (1993). What is the actual relationship between the computer and the user? Does the premium derive from the machine itself, from its software, from the skills it requires, or from the processes for which it is typically used? DiNardo and Pischke (1997), Entorf and Kramarz (1997) and Borghans and ter Weel (2004) argue that the effect comes from the individual qualities of the workers who use the computers. These are simply different types of people from those who do not use computers at work. The cause of any pay effects of computer usage might really

be these individual and occupational differences. We need a way around the problem, and the most attractive is to use longitudinal data where individuals are repeatedly measured over time to control for individual characteristics prior to, for example, being given a PC at work, and for things that are not measured at all (unmeasured heterogeneity). Some of the datasets that underpin the chapters of this book provide just this kind of data, albeit not over long periods – for instance, Home-OnLine (Britain) has three waves, e-Living (six European countries) only two. But with such data, it might be possible to see if there are social changes associated with technological change such as the increased use of e-commerce or of switching to broadband from narrowband Internet access.

If we return to the sociological approach discussed above, we may find a non-statistical solution to this problem, because it often simply disregards it! As we cannot easily distinguish the social from the technological, we cannot ever unravel a 'pure' effect of technology. Nevertheless, even if we partially accept that cause and effect are conflated, we cannot leave it like that. We need a method to ensure that, as far as the relationships in which we are interested can be unravelled, this is done correctly. This applies to any form of analysis, but here we give an example of a common problem with regression techniques, which are prominent in this book. We gain by using these because we nearly always do this in a multivariate form that enables us to produce a precise figure for the statistical effect of one factor on another (or an association between them if we are uncertain of a casual relationship), while controlling for the effects of many other factors. The trouble is that we usually only have part of the picture. We might have information on pay and computer usage at work, and also on gender, education and occupation, which comprise the things we mainly wish to control for. But we often know nothing about, say, motivation. What if computer users earn more not because they use computers or because they are, say, male, better educated and in professional jobs, but because, apart from all that, they are simply more highly motivated? In this case we cannot be sure of our causal relationships.

Very broadly, there seem to be four main approaches to this problem. The first is just to pack the equation with as many control variables as possible (if the data exist), in the hope that the remaining variation associated with the factor or factors of central interest is at least partially controlled. Some chapters in this book take this approach.

Second, assumptions can be made about the conditions under which these problems should occur. For instance, the analysis of the effects of computers on wages is problematic, but we need not assume that this is an issue for gender differences, so we can perhaps legitimately describe the gendering of the apparent computer effect even if we do not fully understand the nature of the causal relationship.

A third approach is to use statistical techniques that deal with variation in the dependent variable which is not given directly by the variables of

interest, for instance latent class analysis, fixed effects, or some two-stage regression process. Each has its own purpose and requirements, but the latter might be formidable. Fixed effects analysis, for instance, requires panel data, whilst two-stage analysis requires a variable which is an effective instrument and this is often not available. Also, not all analysts are familiar with the techniques on offer and, indeed, no chapters in this volume use any of these more complex techniques.

Finally, we can make clear in the discussion of the results that we are uncertain of the causal relationship. Many of the chapters in this book take this approach. For example using the e-Living data, Sofer and Raban (this volume, Chapter 6) have information on usage (for instance of the Internet), personal characteristics such as age and education, and data on competing leisure or technology usage, such as the amount of time spent watching television. Ideally a statistical solution would be found that either controls for the multiple inter-relationships between these (for instance, TV viewers have specific characteristics that affect the likelihood of using the Internet), or explicitly maps the causal relationships. Instead, the authors make certain assumptions that are important in helping us to understand the nature of the problem. One, for instance, is that usage of a particular technology is not determined by, nor determines, other specific usages. Rather, it follows its own path, which we can try to delineate. It might often be better to make such assumptions (if they are reasonable!) rather than to rely on complex statistical techniques.

The social and economic importance of the new ICTs

Much of what we have written above implies that we need analysis, and overviews of research, that combines more than one approach. The emphasis in published work is often primarily from one angle, whether broadly sociological, social psychological or economic. We believe that these aspects are all different sides of the same coinage, even if each offers a very particular type of insight. In this book we have chapters that look at the social and sociological side, but from the economic angle we include work on the relationship between computers and wages (as an indicator of productivity), while on the commercial side we have inputs on the take-up of broadband and on the growth of ICTs in business-to-business operations.

What sorts of effects can these multiple approaches give an insight into? The literature commonly refers to effects that describe how people relate to each other, how they achieve functional goals, whether the patterns of their lives change – especially through the substitution of one activity through another – and how they work. The first of these has been extensively covered elsewhere, especially in books where the predominant ethos is either social–psychological (e.g. Kraut *et al.*, forthcoming) or sociological (e.g. Wellman and Haythornthwaite, 2002). None of our chapters are specifically on the issue of networking. However, three chapters investigate the possibil-

ity that the new ICTs enhance social capital (Ling, Anderson, and Heres and Thomas). The main conclusion that can perhaps be drawn from these is that the case for an ICT effect is not strong. The studies by Ling, and by Heres and Thomas, indicate that there may be some interactions between ICTs and bonding as well as bridging capital. In the case of bonding capital, which stems from strong ties with similar others, Ling's work shows the way in which mobile phones and email are used to maintain informal social networks. In the case of bridging capital, which stems from weak ties with dissimilar others, Heres and Thomas show that even when a range of socio-demographic factors are controlled for, those who engage in civic activities are much more likely to be Internet users than those who do not participate. Whilst neither chapter makes strong claims about causal relationships, we could suggest that either increased ICT usage increases social activity levels (perhaps by facilitating arrangements), or that the socially active need ICTs to help manage their lives – or, indeed, that both are occurring simultaneously. Anderson examines potential ICT effects on life satisfaction, finding generally little causal link between the two.

The question of the achievement of functional goals is mostly considered here on the basis of what particular types of people might wish and expect. Dutton and colleagues use an international comparative dataset to show how use and non-use may be re-configuring access to people, information and services where participation in this process may be becoming an issue of choice as well as of exclusion through social stratification. This is echoed by DiDuca, Partridge and Heres who look at the question of the functionality of ICTs for older people. They show that lower use of Internet among the elderly is a result of lack of knowledge about the technology rather than mere technophobia – older people who are users are no different from other users. They suggest several means of encouraging Internet use among older people, such as through public service delivery, and through health services. Livingstone and Bober analyse the Internet use by young people. Children gain valued social status by their Internet experience and particularly enjoy new opportunities for communications opened by the Internet. In other words, children add a value of their own to the use of the new ICTs. Sofer and Raban discuss in their chapter the gender gaps in ICT access and usage, and note that, at least in the e-Living sample, gender gaps in ICT usage are still to be found. However, one of the strongest determinants of this is workforce participation (which links well with the message of some other chapters). Implicitly, an increase in the participation rates of women will contribute to reducing the gendered gap. The authors point to a gap in the intensity of home Internet usage, associated mainly with more negative attitudes towards computers and the Internet, but overall it is difficult to believe that the gender differences in ICT access and use are anything more than superficial. The technologies may be functional in different ways for men and women (Boneva and Kraut, 2002) but in overall terms probably equally functional. Such social distinctions also appear in the chapter by

Bakardjieva, who addresses how people become a part of the social network of Internet users in Bulgaria, where usage is in its infancy and where the costs of access are high relative to income. Here we see, though, that the standard emphasis on social exclusion breaks down. Now, not only is there no clear exclusion between Bulgarians and people in richer countries, as professionals in Eastern Europe see it as important to be part of the international community, but within Bulgaria illicit provision of and access to services extends the network amongst those who would otherwise be excluded.

Substitution effects are a central part of the modern research effort because these say something directly about the social role of ICTs. If the Internet replaces social life (Kraut *et al.*, 1998; Nie, 2001), then the social effect is clearly negative. But, as Heres and Thomas note in their chapter, perhaps the Internet complements traditional social behaviour. The chapter by Gershuny specifically tackles this issue through the use of panel data to show that people with specific characteristics select into technology uses, rather than being affected by them, and can therefore on the basis of probability be recognised as users *in advance* by these characteristics. The social underpins the technology, not vice versa. Raban in his chapter of trends in usage similarly finds rather weak relationships in the e-Living sample between the daily time spent at home on the Internet and the frequency of several leisure activities (sports, cinema, restaurants, reading and friends' visits). For most leisure activities, increased Internet usage time hardly affects leisure frequency. Similar issues of substitution and the effects of switching to broadband Internet access are discussed in Anderson and Raban, showing that whilst 'broadband for all' may lead to more time being spent online, it may not make much difference to other aspects of everyday life.

To these effects we can add changes that relate not to social life or consumption, but to work. This is important because a very large part of people's active time is spent at work, and so the aspirations and expectations we derive from it, especially through the adequate utilisation of skills, is often fundamental to people's well-being. Whilst some of the most far-reaching effects of the new technologies occur through organisational change, income from work helps to determine consumption levels, and this in turn has major implications for the demand for new technologies and associated services. In addition, income enables people to spend more on traditional services such as house -cleaning, gardening or home improvements (Gershuny, 2000), which releases time for hobbies, or further work which could increase ICT usage and demand.

One element in this network of relationships is the effects of IT usage or skills on wages; if these are positive, an aggregate effect on national productivity (and wealth) is implied through their summation. Alternatively, employers might also introduce computers not only to replace workers but to replace their skills. Much work with computers might therefore be

monotonous, uncreative and poorly paid, leading to a decrease in wealth. Thus analysis has to look out for potential distributional outcomes as well as average effects. Brynin's chapter locates the argument not in terms of productivity but of the gendering of technology, an issue of long-standing interest (Cockburn, 1983), finding that women have gained in general from computers, but also that some women have gained substantially more than others.

The use of a computer is a crude indicator of a technological work process. There are computers for complex and for simple tasks. Using the Dutch dataset, Telepanel, Steijn and Tijdens look at the distribution of usage in terms of three indicators – complexity (especially technical), diversity (of functions or software) and intensity (indicating hours of usage). They find that women are likely to use computers more intensively than men, but also in less complex and diverse ways. Thus, there remains a gender bias in the use of computers at work. The work of Steijn and Tijdens is not explicitly about gender, however. More generally, they argue that we can see a clear distribution in the potential welfare outcomes in terms of quality of the work experience.

Overall work-based effects are perhaps amongst the strongest found in this book, although here too selection issues are at stake. Haddon and Brynin's chapter looks at this with respect to telework, which is often held to be a potential factor in changing the relationship between work and home. It is well known that telework remains a very marginal form of work, but this chapter also argues that its use reflects traditional work patterns and social divisions, rather than adding to them. Nevertheless, improving the quality of life in society, for instance through the encouragement of telework, is one of the key objectives of some governments. However, Anderson and Yttri show that this is difficult to achieve. Not only is there considerable churn to and from traditional forms of work, but switching workstyles seems to have no positive effect on either job satisfaction or overall quality of life. Indeed, in some cases the effect is negative.

Economic effects are, of course, much broader than this, and this is captured by the studies in this book that work at the macro level. Implicit in some of the chapters just discussed is the distribution and utilisation of skills. This has important welfare implications which increasingly span the entire globe. When rich countries lack these skills, at least in sufficient numbers, they often seek to import them. People in poorer countries have at the same time a constant incentive to migrate. The 'brain drain' is an inevitable result. The clearest and most controversial source of this is in the field of medical care, with increasing reliance on (rather weak) bi-lateral agreements between governments to limit this. Yet governments, non-governmental institutions and private companies in poorer countries invest in other skills which are also prone to loss abroad. ICT professionals figure in this, almost to the same extent as health professionals. Here the moral dimension is perhaps less straightforward – after all, the individuals who

choose to migrate have also invested in their skills. Nevertheless, the welfare loss to the originating country could be considerable. Rothgang and Schmidt tackle this difficult subject here in an innovative piece of work that examines the determinants of high-skilled migration into OECD countries and, through analysis of the impact of international demand for skills on the expansion of education in poorer countries, some of the welfare effects. Is there a straight transfer of welfare from poor to rich country, or is it more complex than that?

Even after the subsiding of the Internet bubble, the new ICT developments are clearly big business. One way of looking at this is to examine the share of GDP growth taken up by the new ICTs (OECD, 2003) or, alternatively, the aggregate effects on productivity associated with it (e.g. Black and Lynch, 2001). A further approach to the assessment of the impact of the new ICTs is to measure the share of e-commerce in the world's GDP. Dehio and Graskamp undertake this in their chapter. Looking at 2001, right after the dissipation of the bubble, this share amounted to only 1 or 2 per cent, but they argue that this is expected to rise to 8 per cent in 2010.

Of course computerisation in the workplace need not be simply about getting the job done, although this is paramount, but may also be about reducing environmental costs especially where incentivised by shareholder pressure or tax and legislation regimes. Alakeson and Goodman provide a range of insights into sustainable business practices through the lens of corporate social responsibility. Like Pasquini and Viccario, they highlight the potential benefits of increased dematerialisation whether it be of business transactions (Alakeson) or music consumption (Pasquini), but also note that such benefits are often erased by subsequent rebound effects where people, for perfectly rational reasons, choose to re-materialise digital material.

This wide-ranging discussion of the economic effects of change in ICT development, from aggregate economic indicators, through the effects on the wages and work processes of different social groups, to international flows of skills, denotes distinctive changes in the distribution of social outcomes of various kinds. As our discussion of the direct social effect implies, it is possibly through such economic changes that we will first be able to observe and measure the social effects of the new technologies. This is not to say that social effects that are non-economic in origin are likely to be unimportant, but that they are inherently harder to measure. In setting economically oriented studies alongside the studies of social processes in this book, we hope that readers can build on this more integrated view of ICTs and social change.

Conclusion

If there is one word that perhaps simply encapsulates the changes we have described, it is speed. The things we do – obtain or provide information, communicate with people, buy things, use services – are done or obtained

faster than ever before. Perhaps, in the case of the new ICTs, speed generates a qualitative change in so far as more can be done, more intensively, and perhaps both more freely and knowingly than before (though Marx commented to the effect that the development of the modern press ushered in an age not of instant knowledge but of instant rumour). Writers on postmodernism such as Harvey (1997) have argued that it is the ability to cut and paste life that now makes things so different. According to this view, the new technologies allow the shifting of functions and uses to fit in with personal inclinations. Technologies have lost their bullying, uncompromising nature. Perhaps here we can begin to see how technology is merging with a new social way of doing things. Nevertheless, many of the processes we and others have described touch most people's lives either not at all or at best tangentially.

Our claim is not that there are no social effects of the new technologies. Rather, they are *widespread but weak*. It is also quite clear that, for a long time now, the new ICTs have combined and delivered final services in ways that alter social patterns (Gershuny, 1983). This applies to many household appliances. In respect of information and communications, it applies to telephony, television and even newspapers and books. Yet all these things existed before the new ICTs, which therefore simply intensify and mediate much the same sort of content that have always come through the mass media. Are these new ways of doing things leading to quantitative and qualitative shifts? With the best evidence available, much of which is captured in this book, it still seems too early to tell.

As a result, the chapters in this volume are rightly cautious about making causal inferences and major claims. Rather, most authors see a complex interaction or co-evolution of social and technological change that is producing widespread but weak changes when viewed close up and over short timescales. This book is one assessment of these changes, with a focus, although not completely so, on Europe. Our emphasis on both the social and the economic illustrates the complexity of phenomena that we and the contributors to this volume study. As this introduction has implied, and each chapter will show, this complexity also requires sophisticated data and methods to be able to say anything meaningful, and these are neither cheap to acquire nor easy to apply. We hope that this volume contributes both to the development of these methods and also to the development of more nuanced understandings of the relationships between ICTs and socioeconomic change.

However the book's strongest message must be that we should carefully re-think the simple macro-economic model which supposes that increased quality of life, social cohesion and so forth will automatically follow from ICT innovations and supply-side interventions. Again, we need a more nuanced view. The small effects are certainly occurring. It remains to be seen whether these will merge into some big effect.

Acknowledgements

This research was supported by the European Commission funded Framework 5 project e-Living (IST-2000-25409).

Note

1 See www.itu.int/wsis/.

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